

of the purely meteorological question, and in the meantime place before the reader the conclusions of this essay:—

1. The idea of centripetal hurricanes of aspiration originates in an illusion of the sense of sight; it is an old prejudice whose history it is easy to follow from the most remote times to the present day.

2. The theory of centripetal hurricanes, suggested by this prejudice and the hypotheses which it implies, cannot be accepted. The adoption of similar ideas by enlightened minds is only to be explained by the venerable authority of this prejudice.

3. Bases of the mechanical theory of gyratory movements; agreement of that theory with the Laws of Storms. These ought to be considered as a first but excellent approximation; a means of making further advances.

1. *History of a Nautical Prejudice.*—In the midst of the profound calm which often precedes thunderstorms, the lower strata of the atmosphere are not agitated by the least breath; heavy clouds approach at a great speed and cover the sky—a clear proof that powerful currents prevail above, the influence of which does not extend to the ground. From one of these clouds a sort of bag or end of a tube or funnel is seen to issue, and which gradually descends, lengthening at the same time. It seems to be formed of the same material as the cloud; and in fact is a true fog which envelops the cloud, thus rendering it visible to our eyes.

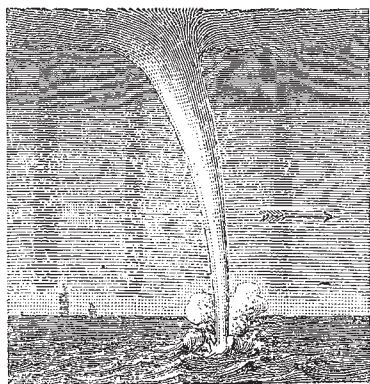


FIG. 5.

Meantime the centre of this funnel is agitated by a violent whirling movement of which the small whirlwinds of dust that are sometimes seen on our roads give a very accurate idea. When the waterspout reaches the ground and encounters obstacles in its way, it sets to work upon these after the manner of a turning machine of great speed at the end of a vertical axis. It raises around its lower extremity a cloud of dust, overturns trees, batters down walls, and unroofs houses. If, instead of land, the waterspout meets with a water surface, it acts upon it like a square-bladed scoop at the end of a vertical axis, and the churned water is thrown to a distance in foam; if it advances on a pool, it empties it in an instant; if on a lake or a sea, the water spurts out all round the foot of the waterspout in clouds of spray.

Look particularly at this long vaporous tube (Fig. 5), which extends from the surface of the earth to the clouds, to a height of from 1,600 to 2,000 feet and upwards; it appears flexible, and has an undulatory movement through its entire length: the least breath of air alters and distorts its form; and its whirling movements are felt down even to its base, which sweeps over the earth, carrying devastation in its train. If it assumes greater dimensions, it is no longer a waterspout, but a tornado. We have here in two words the history of the tornado of Jan. 20, 1854, which occurred in the county of Knox, Ohio, and which

in half an hour levelled 50,000 trees with the ground, hewing for itself a pathway through the forest a quarter of a mile broad, which could not have been made in some weeks by a whole army of backwoodsmen.

The tube, which takes the form of a pillar, a funnel, the trunk of an elephant, &c., usually disappears after being as it were broken across, by the violence of its own gyratory movements. Further, the misty vapours which compose it slowly ascend, and the combination of the ascending and whirling motions gives the appearance, when seen at some distance, of a spirally ascending movement, which, however, bears no relation to the internal gyrations of the waterspout. Movements, not real but illusory, are all that are perceived. The spectator supposes he sees objects ascending in the interior of the waterspout. Thus a bit of cloudy vapour looks like a bird caught by the waterspout and rapidly whirled aloft. If the vermicular motion is continuous and along the whole length of the waterspout, the question is asked, what can in this manner ascend in a long tube whose base is plunged into the sea and which violently agitates its surface. At once and without any inquiry the logic of the imagination comes into play, and the conclusion is come to that it is the water of the sea which the waterspout is in quest of; this it pumps up and distributes among the clouds, and its ascent up the tube is plainly seen. No question is put as to how a tube composed of aqueous vapour can hold and sustain deluges of solid water. Moreover, are the clouds not seen rapidly to grow portentously heavier and bigger by the water so abundantly supplied by the waterspout?

It were idle to listen even to observations made under such impressions. For thousands of years sailors have transmitted from age to age tales of waterspouts which have lifted ships into the air, sucked up the water of the sea, and poured it down again on some hapless ship which was unfortunate enough to pass under and break the tube of the spout. Tales like these, unceasingly reproduced with ever-fresh details, powerfully aid the illusion in determining the event before it is seen.

(To be continued.)

NOTES

AN interesting service to astronomy has been rendered by Mr. Davidson, the head of the American Transit Expedition to Nagasaki, Japan; he has determined the exact site of Abbé Chappe d'Auteroche's Observatory in 1769, when he observed the transit by order of the French Academy of Science, at St. Joseph, California. As Abbé Chappe died soon afterwards from a fever caught while fulfilling his mission, his narration was completed by people who had never been on the spot; a blank has been left in the records of his observations, which has now been filled up 108 years after the event. The Abbé Chappe was an uncle of the celebrated Chappe who invented telegraphs during the wars of the Revolution.

M. LECOCQ DE BOISBAUDRAN, who is well known in connection with spectroscopic analysis, has just announced the discovery, by means of the spectroscope, of a new chemical element which he calls *gallium* and affirms to be closely allied to zinc. The spectroscopic character of gallium is two violet lines, one corresponding to wave-length 417, and the other to 404, but fainter. The communication was made by M. Wurtz, at Monday's sitting of the French Academy. A commission has been appointed to report on the discovery. Gallium is said to be found in a special blende from Pierrefite mining works, in the Argeles Valley.

It appears that M. Janssen's observatory is to be built at Fontenay at the expense of 80,000 francs. A sum of 50,000 francs is to be spent on instruments, exclusive of the apparatus used in the transit of Venus. He is to have two assistants, each of

them receiving 4,000 francs yearly. The instruments are to be under the direct supervision of the Minister of Public Instruction.

METEORS of unusual brilliancy have been seen from several points of late. We recently noticed one seen from the Radcliffe Observatory, Oxford, on Sept. 3, and from the same place we learn that a large meteor was observed on Sept. 7, 11h. 21m. Greenwich mean time, about twice the apparent magnitude of Jupiter, increasing to about four times that of Jupiter, with an accompanying tail of about 5° in length, from near 4 Arietis to a point near γ Tauri, where it burst into five or six pieces. Colour, blue to green, with red at bursting. Time visible, about seven seconds. It was seen by Mr. Lucas and Mr. Bellamy. Another very peculiar one was seen from Edinburgh and neighbourhood on the 11th inst. A Burntisland correspondent, Mr. G. J. P. Grieve, writes that about 11 P.M. that evening, while pacing a gravel walk in moonlight and partly gaslight, a sudden vivid gleam from behind threw his shadow clear cut on a bright ground. Turning sharp to see the origin of the blaze, after a second or so he noticed a serpentine meteor: the glow or trace left in the path of a shooting star, whose maximum intensity, if not explosion, lay at the west end of the trace. The trace appeared in Auriga, and so close to the three leading stars next south of Capella, that he had not the least difficulty in sketching the position. The particulars are these:—Station in lat. N. 56° 3' 57"; long. W. 3° 13' 10". Position of meteor, in constellation Auriga. Duration from first blaze to disappearance of trace, three to four minutes. Timed at disappearance of trace, 11.24 P.M. by Edinburgh gun time. Several letters on this serpentine meteor—"the sky snake" they call it in the north—appear in the *Scotsman*, all agreeing as to its peculiar form and great brilliancy. One observer near Mid Calder "was attracted by the appearance of a magnificent meteor, which was visible for about two seconds, and which, being apparently interrupted in its flight, assumed a zigzag course; and, flashing brightly at each angle thus formed, it disappeared, leaving the snake-shaped track behind it, which was visible for several minutes afterwards, finally disappearing in the form of a ring." On the night of the 14th inst. another magnificent one was visible, apparently over all England. It is noticed in the *Bradford Observer* of the 15th, and Mr. T. W. Shore writes us that he saw it while in the Southampton Water. The time of its appearance, both in the north and south of England, was 8.30 P.M. Mr. Shore, while looking towards the land on the north, observed the meteor commence its luminous course at an apparent altitude of about 30°, and travel to the horizon in a direction from S.E. to N.W. The meteor appeared to him to be about three or four times the brightness of Jupiter, and the time of its course rather more than two seconds. The *Bradford Observer* states that "all accounts agree in saying that it presented the appearance of a flying body of light of considerable size, and that during the period of its passage it lighted the whole sky. It would seem that it first made its appearance from the south-west, its course being over Bowling Park and in a north-westerly direction over Bowling, Horton, and Manningham, and a spectator describes it as an oblong body of light, several feet in length, and bearing the appearance of some solid body in a state of combustion, the sparks flying out on all sides, and a track of flame being left after its passage. Its passage was accompanied by a noise as of a loud explosion, which was plainly heard, not only by those who were outside, but by persons inside the houses who did not see the aërolite itself. All parties concur in saying that so strong a light was cast around that a newspaper could easily be read for the space of half a minute." The same meteor was seen from Manchester and London, and no doubt from various other places. In the report of the meteor of Sept. 3, δ should be λ Piscis Australis.

In order to stimulate research, experiment, and invention, and to promote the advancement of mining enterprise in Cornwall and Devon, Mr. G. L. Basset, of Tehidy, offers prizes under the following conditions:—1. For the discovery of a new mineral, in Cornwall or Devon, which is deemed likely to become commercially valuable, a prize of 50%. An accurate analysis and a description of the leading physical properties and distinguishing characteristics of the mineral to be given, specimens to be handed to the Committee, and the locality and mode of occurrence to be distinctly described. 2. For the invention of a method—mechanical or chemical—of making marketable with commercial advantage, ores or minerals produced in Cornwall or Devon, and hitherto regarded as worthless or of little value. The method to be clearly described, and specimens of the product in its several stages to be handed to the Committee; or, for the discovery of some new application of a mineral substance already known to occur in Cornwall or Devon, either by itself or in combination, to some useful purpose, so as to render it of marketable value, or materially to enhance its value if already marketable to some extent—a prize of 100%. The prizes to be awarded at the discretion and according to the judgment of a Committee, consisting of the President and Hon. Sec. of the Miners' Association, and some other gentlemen to be nominated by Mr. Basset. All communications on this subject must be addressed, in the first instance, to Mr. J. H. Collins, F.G.S., hon. sec. of the Miners' Association of Cornwall and Devon, 57, Lemon Street, Truro.

ACCORDING to information communicated to *Aftenbladet* from Christiania, the Norwegian vessel, which in the end of August met Nordenskjöld west of Novaya Zemlya, was the yacht *Elvire Dorothea*, belonging to J. Berger, in Hammerfest. The yacht has returned from the Arctic Sea to Hammerfest. Its master, Johan Alexandersen, states that the Sea of Kara was nearly free of ice, and that it cannot be doubted that Nordenskjöld will reach the goal of his journey, the River Obi.

M. LEVERRIER has announced to the French Academy that Mr. Hind, the superintendent of the *Nautical Almanack*, intends to employ his new Tables of Saturn as soon as they are printed. He reminded the Academy that this will be the sixth table constructed by him that the British Admiralty has introduced into the almanack, and he expressed his sense of the honour thus done him by the Admiralty.

AN interesting and very useful publication comes to us from Germany, under the title of "Die Fortschritte des Darwinismus," by J. W. Spengel (Cologne and Leipzig, E. W. Mayer). This is the second number of the publication, and originally appeared as a paper in Klein's *Revue der Naturwissenschaften*. The purpose of the brochure of eighty pages is to give a brief review of all the works and articles of importance bearing on Darwinism, either *pro* or *con*, published during 1873-4. A very large number of such works, in various languages, is noticed, and their bearing on the Darwinian hypothesis pointed out. The work will be found of great use to those who have not access or have not time to consult all the various publications bearing on the important theory, and will also serve as an excellent bibliography to those who wish to make a thorough study of the subject.

THE German Scientific and Medical Association was opened at Graz on the 17th inst. Lieut. Weyprecht, of the recent Austrian Arctic Expedition, made a speech deprecating all past Arctic expeditions as adventurous and valueless because they constituted an international rivalry that resulted only in giving names to some ice-bound islands. The speaker, amid general applause, expounded a new programme for making Arctic expeditions more fruitful for natural science, and to enable poorer countries to undertake such expeditions.

In the *American Boston Medical and Surgical Journal* for July there is a paper by Dr. H. P. Bowditch, on the course of

the nerve-fibres in the spinal cord. From his experiments the author demonstrates, in opposition to the results of many other investigators, that the channels of motor and sensitive impressions lie in the lateral, and not in the anterior and posterior columns of the cord.

THE International Congress of Physicians was opened at Brussels on Sunday by the King of the Belgians with great ceremony.

IN connection with the Science and Art Department, South Kensington, the following candidates have been successful in obtaining Royal Exhibitions of 50*l.* per annum each for three years, and free admission to the course of instruction at the following institutions:—1. The Royal School of Mines, Jermyn Street, London: John Gray, engineer; Frederick G. Mills, student; Thomas E. Holgate, farmer. 2. The Royal College of Science, Dublin: C. C. Hutchinson, engineer; Henry Hatfield, student; Thomas Whittaker, clerk.

PROF. FLOWER's important monograph on the structure and affinities of the Musk-deer (*Moschus moschiferus*) has just appeared in the new 3rd part of the Proceedings of the Zoological Society for this year.

WE commend to our readers a paper in Tuesday's *Daily News* on the scientific work of the *Valorous*, by a member of the expedition. Under somewhat trying circumstances much good work was done. Many new and valuable facts bearing upon the very important question of the geographical distribution of particular forms have been added to those already obtained by the *Porcupine* and *Challenger*.

IN a letter in the *Morning Post*, signed "W. S. M.," attention is drawn to the provision in the New Code of the Privy Council Committee of Education for instruction in cooking, house management, &c., in elementary schools, and a very happy suggestion is made. The writer can see no reason why some portions at least of the subject should not at once be introduced into all schools which are in connection with the Science and Art Department. He then shows how very large a number of students attend the classes for Animal Physiology, Organic and Inorganic Chemistry, and Heat, and says: "There is thus already given, though scattered over four subjects, much of the instruction which would belong properly to the special subject of 'Food and its Preparation.' To make the subject an efficient one, all that is needed is to select certain portions from the subjects already taught, 'Physiology,' 'Acoustics, Light, Heat,' 'Inorganic Chemistry,' 'Organic Chemistry;' to group these portions as one subject, and to add to it some additional instruction that is not at all more difficult than much that is already given." We commend "W. S. M.'s" suggestion, indeed the whole of his letter, to the notice of the South Kensington authorities.

THE Cryptogamic Society of Scotland will hold its first Annual Conference at Perth on September 29 and 30, and October 1, the president being Sir T. Moncreiffe, of Moncreiffe, Bart., President of the Perthshire Society of Natural Science, and the secretary, F. Buchanan White, M.D., F.L.S., editor of the *Scottish Naturalist*. The following is the programme of the meeting:—Wednesday, September 29, field-excursions to Moncreiffe, Dupplin, and Scone. Thursday, September 30, (1) Arrangement and examination of specimens; (2) Business meeting (reading of papers and communications, &c.); (3) Fungus dinner. Friday, October 1, show of fungi and other cryptogamic plants in the City Hall, Perth. All fungi, &c., intended for exhibition must be delivered (addressed to the care of the "Keeper of the City Hall, Perth") not later than 10 A.M. on Thursday, September 30. Ferns in pots must be

delivered between 8 and 10 A.M. on Friday, October 1. Botanists (especially in distant localities) who purpose attending the conference are requested to give early intimation of their intention, in order to facilitate arrangements. Further information may be obtained on application to the general secretary, Dr. Buchanan White, Rannoch, Perthshire; or the local secretary, Mr. J. Young, C.E., Tay Street, Perth.

A FRENCH blacksmith has devised a perforated plate, put in rotation by clockwork, and intended to place behind the lock of a safe. The consequence is that the safe cannot be opened except at certain times during business hours, when there is no danger of any robber intruding into the offices.

THE patrons of the Lille Catholic University are trying to get an hospital placed at their disposal in order to start a school of medicine, and they have offered a sum of 150,000 francs to the administration of public hospitals in order to have a *clinique* of their own. The answer has not yet been given, but it is doubtful whether the requisition will be complied with.

THE death of M. Duchesne de Boulogne, one of the most celebrated practitioners who engaged themselves in studying medical electricity, took place on Saturday, Sept. 18. M. Duchesne de Boulogne was the author of several cleverly written books on the subject. His death will be felt as a loss by those who are organising the International Exhibition of Electricity, which is to take place only in 1877, having been postponed owing to the amount of work required to collect all the objects relating to that immense science.

THE admirable "Report [on the Progress of the Iron and Steel Industries in 'Foreign Countries,' by Mr. David Forbes, F.R.S., has been reprinted in a separate form in the *Journal* of the Iron and Steel Institute.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mrs. Kent; a Common Raccoon (*Procyon lotor*) from North America, presented by Mr. W. Binder; a Goffin's Cockatoo (*Cacatua goffini*) from Queensland, presented by Mrs. Barton; an Egyptian Gazelle (*Gazella dorcas*) from Egypt, a Green Monkey (*Cercopithecus callitrichus*) from West Africa, a Brazilian Hangnest (*Icterus jamaicæ*) from Brazil, a Sulphury Tyrant Bird (*Pitangus sulphuratus*), two Red-rumped Hangnests (*Cassicus hamorrhous*), three Blue-bearded Jay (*Cyanocorax cyanopogon*) from South America, deposited; a Gtullian Ground Squirrel (*Xerus xerulus*) from Morocco, six Houbara Bustards (*Houbara undulata*) from North Africa, purchased; a Wapiti Deer (*Cervus canadensis*), and a Reeves's Muntjac (*Cervulus reevesi*) born in the Gardens.

THE BRITISH ASSOCIATION REPORTS.

Third Report on the Sub-Wealden Exploration.—Mr. W. Topley made a statement on this subject, embodying the chief points of the report drawn up by Mr. H. Willett and himself. Up to the year 1872 nothing was known as to the beds which lie below the Wealden strata in the south-east of England. The lowest beds exposed were those on the north and north-west of Battle, long worked for limestone. The age of these beds was doubtful, some geologists correlating them with the Purbecks of Dorsetshire, others regarding them as Wealden but of somewhat exceptional character. In 1872, when the Association met at Brighton, Mr. H. Willett proposed to commence a bore hole in these doubtful strata, with a twofold object: (1) to determine the order, thickness, and character of the Secondary rocks below the Weald; (2) to prove the Palæozoic rocks which were supposed to lie beneath at a depth which could be reached. Judg-